

## **HEAT SEAL DIE AND SYSTEM AND METHOD FOR PORTION CONTROL SIZED PACKAGING**

### **Technical Field**

[001] This invention relates to heat seal dies used to form a heat seal between two heat sealable surfaces such as thermoplastic film. More particularly, this invention relates to heat seal dies for use in portion control sized packaging machines to form top and bottom seals of packages made from thermoplastic film.

### **Background of the Invention**

[002] Flexible packaging such as thermoplastic film is commonly used in form/fill/seal equipment for packaging fluid material such as food products. In form/fill/seal systems, material is placed inside tubular thermoplastic film and the top and bottom of the tubular film is heat sealed with a heat seal die to encase the material. Condiments such as ketchup and mustard are often packaged this way.

[003] Temperature variation across the length of the heat seal die can produce packages that leak fluid material or serum over a period of time. This phenomenon occurs when the sealing temperature of the end seal dies exceeds or falls below the sealing range of the material. These suspect packages may not be evident to the operator of the form/fill/seal machines since the temperature controller only senses the temperature on one small area of the die. This condition often results in contamination of entire boxes of packaged goods containing large numbers of individual packets of product. Therefore, there is a need for more reliable form/fill/seal equipment.

### **Summary of the Invention**

[004] This invention encompasses a heat seal die incorporating heat tube technology for controlling the variation of temperature across a heat seal die. The invention also encompasses a system and method for portion control sized packaging using such a heat seal die.

### **Brief Description of Drawings**

- [005] Fig. 1 is a perspective view of a heat seal die made according to an embodiment of this invention.
- [006] Fig. 2 is an end view of one die member illustrated in Fig. 1.
- [007] Fig. 3 is a schematic diagram of a form/fill/seal system in accordance with an embodiment of this invention.
- [008] Fig. 4 is a plan view of a heat sealed package formed in accordance with an embodiment of this invention.

### **Detailed Description of Embodiments**

- [009] This invention encompasses a novel heat seal die and a novel system and method for making portion control sized packaged goods.
- [010] Turning to Fig. 1, a heat seal die 10 for forming a heat seal between two heat sealable surfaces such as a thermoplastic film or laminate comprising a heat sealable thermoplastic component is illustrated and generally comprises a first die member 12, a mating second die member 14, respective first and second heating elements 16 and 18 disposed in the first and second die members, and respective first and second heat tubes 20 and 22 disposed in the first and second die members.
- [011] Each of the first and second die members 12 and 14 comprise a body 24 made of rigid heat conducting material such as metal. A wide variety of metals can be used to form the die member body 24, but 440 stainless steel is particularly preferred because of its hardness and wear resistance.
- [012] The die member body 24 extends from a first end 26 to a second end 28 along a longitudinal axis. First and second opposing side members 30 and 32 extend from a first end 26 to the second end and a raised portion 34 extends from between the first and second longitudinal sides. The raised portion 34 has sloping walls 36 extending outwardly and inwardly from the respective first and second sides 30 and 32 to a die face 40.
- [013] The die faces 40 of the first and second die members 12 and 14 include alternating lands 42 and grooves 44 which mate when the first and second die members engage to heat seal material such as thermoplastic polymer. A desirable land and groove configuration is illustrated in U.S. Patent 4,582,555, the disclosure of which is incorporated herein by reference in its entirety. Although a land and groove

configuration is desirable, it should be understood that other die face configurations such as flat surface may also be used.

[014] Each of the first and second die members 12 and 14 have a first longitudinal bore 46 extending from one end 26 of the die member body 24 to the other end 28 proximate the die face 40. The first and second longitudinal heat tubes 20 and 22 are tightly disposed in the respective first bores 46 of the first and second die members 12 and 14. A second longitudinal bore 48 extends from the first end 26 to the second end 28 of each of the first and second die members 12 and 14 and receive the respective first and second longitudinal heating elements 16 and 18.

[015] The first and second heat tubes 20 and 22 desirably extend the length of the first and second die members 12 and 14. Generally described, heat tubes comprised a closed metal tube such as a copper or aluminum tube. The tube contains a wick, with the remainder of the internal volume filled with a liquid under its own pressure. As the temperature along the heat tube changes, the fluid in the hotter area of the tube boils, picking up latent heat of vaporization. This high pressure gas travels to the lower pressure (cooler) area of the tube and condenses, thus transferring heat to the cooler area. This cycle in the heat tube equilibrates the temperature across the heat seal die members 12 and 14 and keeps such temperature substantially uniform. The heat tube suitable for any particular embodiment of this invention depends on the desired temperature range of the heat seal die and the length of the heat seal die. The heat seal tubes 20 and 22 can be chosen to limit the temperature variation across the length of the die members 12 and 14 as desired. It is often desirable to keep the temperature variation across the length of the die members 12 and 14 less than 10°F and even more desirably less than 5°F. Although the temperature of the die members 12 and 14 will vary depending on the particular heat sealable material being sealed, the temperature normally ranges from 200° to 400°F.

[016] Suitable heating elements 16 and 18 include a variety of conventional heating elements. A particularly desirable heating element is a heating cartridge which fits tightly within the second bores 48 of the first and second die members 12 and 14.

[017] As shown in Fig. 2, the heat seal die 10 also comprises a temperature sensor 50 disposed in the first side 30 of each die member 12 and 14. A thermocouple is one suitable temperature sensor. Desirably, the temperature sensor 50 is disposed in the first side of each die member 12 and 14 because this side faces downwardly during operation of the heat seal die 10. Accordingly, when the heat seal die 10 is washed with water, as is sometimes necessary, the water flows over the heat seal die without cooling

the first side 30 of the die members and therefore does not affect the temperature sensor. Washing of the heat seal die 10 only cools the outer surface of the heat seal die and if the water contacts the area of the heat seal die near the temperature sensor, it can cause the temperature sensor to give a false reading.

[018] The heat seal die 10 is particularly suitable for heat sealing a laminate of film, foil, and thermoplastic sealant in a conventional form/fill/seal packaging unit 52 as illustrated in the schematic diagram in Fig. 3. A film feeder 54 feeds heat sealable laminate to the form/fill/seal unit 52 between the opposing die faces 40 of the heat seal die 10. A flowable material feeder 56 delivers flowable material for the packaging to the form/fill/seal unit 52. The unit 52 is useful for packaging of variety of flowable materials including liquids, sauces, purees, jells, pastes, and in particular, condiments, such as mustard, ketchup, and relish. This system is particularly suitable for packaging portions within the range of one to five ounces each.

[019] The packaging system of this invention produces sealed flexible packages 58 such as illustrated in Fig. 4. Each package 58 comprises a heat sealable packaging material 60 with a top seal 62, a bottom seal 64, and side seals 66 and 68 formed by the heat seal die 10 and the form/fill/seal unit 52. As the heat sealable packaging material passes between the opposing die faces 40, the heat seal die 10 forms the top heat seal edge of one package and the bottom heat seal edge of another package. A knife housed in the form/fill/seal unit 52 separates the two packages by severing the film just after the heat seals are formed.

[020] The described embodiment reduces the occurrences of serum leakers in portion controlled sized packages. Serum leakers are packages which leak liquid through the package heat seal.

[021] It should be understood that the foregoing relates to particular embodiments of the present invention, and that numerous changes may be made without departing from the scope of the invention as defined in the following claims.